

campus, interconnect LMDS sites, or serve as microcell feeder links in a cellular or PCS network.

In Section 101.141(a), the Commission requires a 1 bps/Hz spectrum efficiency rate for all frequency bands below 19.7 GHz and for the Digital Electronic Message Service. This 1 bps/Hz efficiency standard also is appropriate for the 23 GHz Band because it would ensure that all proposed bandwidths are fully utilized and because, as discussed in Section III.B, supra, the digital 18 GHz Band radio models that likely would be retrofitted for 23 GHz Band operation are designed to this standard. Thus, the 1 bps/Hz spectrum efficiency standard must be required for digital radios used in all frequency bands below 25.25 GHz, including the 23 GHz Band.³⁰

D. Section 101.147(s) Should Be Amended To Bring Low Power, Limited Coverage Systems in the 23 GHz Band Up to Date.

Various low power, limited coverage FS systems operate in the 23 GHz Band. These systems include perimeter surveillance applications and remote video monitoring.

Severe congestion exists in the low power, limited coverage frequency band. To help solve this problem, the TIA Fixed Section proposes designating an additional 200 MHz in the 23 GHz Band for this service. These new frequencies would be

³⁰Appendix A at Section 6.

adjacent to the current low power band in the 21.8-22.0 GHz and 23.0-23.2 GHz band segments and would be reserved primarily for narrow band systems.³¹

The Part 101 requirements for these low power, limited coverage systems are not congruent with their operations and therefore must be revised. The TIA Fixed Section proposes adoption of the following changes to bring Section 101.147(s) up to date:³²

- ◆ Maximum Power Definition -- The maximum power for FS systems is expressed as an "EIRP." Section 101.147(s) requires that the maximum "ERP" must be less than 55 dBm for fixed low power 23 GHz Band systems. This power level must be changed because ERP is appropriate for mobile, not fixed, services. Using an industry standard formula, the maximum EIRP should be 55 dBm.
- ◆ Frequency Tolerance -- Section 101.147(s) specifies 0.05% as the frequency tolerance for low power, limited coverage systems. This standard is even looser than the 0.03% standard required in the 23 GHz Band. It is important to set a uniform frequency tolerance standard of 0.001% covering all shared services in the band.
- ◆ Special Showings -- Section 101.147(s) requires special showings to be included with the license application if a 50 MHz bandwidth channel is requested or if a system has more than five (5) hops in tandem. Both these requirements should be deleted from Part 101 because they no longer are necessary.
- ◆ Interference Criteria -- Section 101.147(s) specifies additional interference criteria for low power, limited coverage systems. However, typical radios already meet these interference criteria,

³¹Appendix A at Section 4. Wideband systems also could use these frequencies if no other appropriate frequencies are available.

³²Appendix A at Section 7.

making them unnecessary. A uniform frequency coordination procedure should be used for all services in the 23 GHz Band.

- ◆ **Antenna Standards** -- As detailed in Section IV, infra, the TIA Fixed Section proposes amending Section 101.115 to permit use of a 1-foot diameter antenna throughout the entire 23 GHz Band. If this proposal is adopted, the existing special exclusion in Section 101.147(s)(4), allowing 1-foot diameter antennas, no longer would be needed and should be deleted.

IV. ANTENNA STANDARDS FOR THE 23 GHz AND 10 GHz BANDS SHOULD BE MODIFIED

Many FS users need to employ small antennas. For example, PCS operators plan to use FS to interconnect cell sites. The majority of these sites, however, are located on rooftops, monopoles, electrical transmission towers, and other structures that cannot support large microwave dishes. An increasing number of homeowner associations and zoning boards object to the diminished aesthetic value caused by the appearance of numerous cell sites in their neighborhoods. Therefore, in response to the concerns of its potential customers, PCS operators prefer to use small antennas.

However, 23 GHz Band and 10 GHz Band antenna standards restrict the use of such small antennas. In the 23 GHz Band, 2-foot diameter antennas are the smallest permissible size instead of a preferable 1-foot or 18-inch diameter; in the 10 GHz Band, 4-foot antennas are the smallest permissible size instead of a preferable 2-foot diameter.

The existing antenna size restrictions deter FS use of the 23 GHz Band and the 10 GHz Band. The TIA Fixed Section recommends making it easier to use these bands

by revising antenna standards to permit 18-inch or 1-foot high performance antennas in the 23 GHz Band and 2-foot or 4-foot antennas in the 10 GHz Band.³³

A. 23 GHz Band Antenna Standards Should Accommodate Increased Need For Short Paths.

If the rules proposed herein to open up the 23 GHz Band for FS users are adopted, there will be an increased need for short (e.g., 1-2 miles) microcell interconnect and LMDS infrastructure link point-to-point microwave paths. Eighteen inch and 1-foot antennas in the 23 GHz Band provide sufficient path reliability for these applications, while maintaining the industry's desired low visual profile.

Moreover, these smaller antennas are used in the 23 GHz Band worldwide. Regulations should be harmonized with those of other countries.³⁴ This harmonization would allow U.S. antenna and radio manufacturers successfully to design common products for domestic and foreign markets, obtain economies of scale, and increase competitiveness.

To permit 18-inch or 1-foot diameter antennas in the 23 GHz Band, the TIA Fixed Section recommends that the Commission:

³³Appendix A at Section 8.

³⁴For example, Canada recently adopted new antenna standards for the 23 GHz Band, which permit the use of one foot antennas in uncongested areas. Technical Requirements for the Fixed Line-of-Sight Radio Systems Operating in the Bands 21.8-22.4 GHz and 23.0-23.6 GHz, Industry Canada Technical Standard SRSP-321.8 at 8 (July 19, 1997). The United Kingdom Radio Communications Agency also permits 1-foot antennas in the 23 GHz Band. United Kingdom Radio Communications Agency, Performance Specification MPT 1409, Figure 3.2.

- ◆ Change the minimum antenna gain from 38 dBi to 33.5 dBi. Several U.S. antenna manufacturers recommend this revision so it conforms with international standards.
- ◆ Change the maximum beamwidth from 2.2 to 3.3 degrees.
- ◆ Retain the same front-to-back ratios as the current Category A and Category B radiation standards, tighten the Category B front-to-back ratio (as proposed in the revised Section 101.115(c) chart),³⁵ and reduce the sidelobe suppression requirements to allow smaller antennas.

Under this proposal, for the 23 GHz Band, the 18-inch diameter antenna would qualify under Category A and the 1-foot diameter antennas would qualify under Category B.

B. 10 GHz Band Antenna Standards Should Accommodate Paths Longer Than 2.3 Miles.

A key advantage to the 18 GHz Band is the ability to use small 2-foot antennas. However, 2-foot antennas are not permitted in the 10 GHz Band. If antenna standards are changed to permit smaller antennas in the 10 GHz Band, studies indicate that this band will be more attractive for paths longer than 2.3 miles.

Current Part 101 provisions effectively set a minimum antenna diameter for the 10 GHz Band at 4-foot. To permit 2-foot antennas, the TIA Fixed Section proposes that the Commission:

- ◆ Change minimum antenna gain from 38 dBi to 33.5 dBi. This proposed minimum gain is consistent with the Commission's recent recommendations regarding directional antennas.³⁶

³⁵See Appendix B.14, Antenna Standards, "Minimum radiation suppression to angle in degrees from center line of main beam in decibels."

³⁶Amendment of Parts 74, 78, 101 of the Commission's Rules to Adopt More Flexible Standards for Directional Microwave Antennas, Report and Order, 12 FCC Rcd

- ◆ Change maximum beamwidth from 3.4 to 3.5 degrees so that there would be a uniform beamwidth for all 10 GHz Band systems.
- ◆ Change radiation standards for Category A and Category B to the same standards that applied for the 10.55-10.68 GHz band before June 1, 1997.³⁷ However, the front-to-back ratio for Category B channels should be tightened, as proposed in the revised Section 101.115(c) Antenna Standards chart.³⁸ These new radiation standards would permit use of a shrouded 2-foot high performance antenna to meet Category A specifications and an unshrouded 4-foot standard antenna to meet Category B specifications.

V. MINOR MODIFICATIONS SHOULD BE MADE TO UPDATE AND CLEANUP SPECIFIC SECTIONS

The Part 101 rules have been in effect for over a year. While this comprehensive set of rule changes works well, certain inconsistent and unnecessary rules must be revised or eliminated. Thus, the TIA Fixed Section proposes the following minor changes to Part 101, which are detailed in Appendix A at Sections 9-11:

- ◆ Minor modifications should be made to the Table of Maximum Authorized Bandwidth in Section 101.109 to reflect the proposed 23 GHz Band plan and to delete erroneous references to LMDS systems in that band.
- ◆ After the creation of Part 101, Parts 25, 74, 78, and 90 continue to reference the old section numbers of Parts 21 and 94. These obsolete references must be corrected to reflect the Part 101 consolidation process.

1016, 1035 (1997).

³⁷47 C.F.R. § 101.115 (1998).

³⁸See footnote 35, supra.

VI. TELEVISION BROADCAST AUXILIARY SERVICE RULES MUST BE REVISED

Broadcasters are undergoing significant changes in how they deliver programming. Digital transmission technologies, especially HDTV, are forthcoming. To ensure that these new technologies can be utilized fully, the TIA Fixed Section proposes the following changes in Subpart F of Part 74:³⁹

- ◆ Digital Modulation - Currently the Commission does not allow digital modulation in the 1.990-2.110 GHz, 2.450-2.4835 GHz, 6.875-7.125 GHz and 12.7-13.25 GHz bands. However, broadcasters will need to use the 1.990-2.110 GHz and the 2.450-2.4835 GHz bands for Electronic News Gathering ("ENG") applications and they will need to use the 6.875-7.125 GHz and the 12.7-13.25 GHz bands to transport a HDTV digital signal along with their existing analog signal on Studio to Transmitter Link ("STL") microwave paths. The restricted bands are the most heavily used bands for STL. The emission limits of Part 74 should be changed to permit digital modulation in the 1.990-2.110 GHz, 2.450-2.4835 GHz, 6.875-7.125 GHz and 12.7-13.25 GHz bands in order to support ENG and to support HDTV over STL microwave links.
- ◆ Maximum EIRP for Short Paths - The maximum EIRP limit in Part 74 should be changed to reflect the same equation that is used in Section 101.143(b). This change will allow high reliability on digital STL paths in the Part 74 bands and would prevent the problems encountered in the old Parts 21 and 94.
- ◆ Technical Standards for 2.110-2.130 GHz Band - The 2.110-2.130 GHz band has been redesignated for the Broadcast Auxiliary Service, but corresponding technical standards have not been prescribed. Thus, the TIA Fixed Section recommends that the

³⁹Exhibit A at Section 12.

Commission revise existing Part 74 technical standards for transmitter power, EIRP, antennas, and frequency tolerance.⁴⁰

- ♦ ATPC - ATPC is a method used in digital radios to reduce the normal transmit power by 10 dB or more during normal propagation conditions. ATPC provides a great benefit in reducing interference levels into other microwave paths, thereby allowing more frequencies to be coordinated in a particular geographic area. ATPC protects against receiver overload from an excessively strong signal during abnormal propagation conditions. By operating at a lower power level for most of the time, ATPC reduces the power consumption of the particular radio, thereby lowering operating costs and increasing equipment reliability. The TIA Fixed Section recommends expressly permitting ATPC in the Television Broadcast Auxiliary Service.

CONCLUSION

Continued FS expansion is threatened. Bands are congested. Assaults on these bands by incompatible satellite users are increasing at an alarming rate. No immediate relief is in sight.

For once, making adequate FS spectrum available must be a Commission priority. These users, which provide critical public and private sector services, have been neglected far too long.

The proposals made herein to increase FS use of the 23 GHz Band (as well as the 10 GHz Band) is a precise plan for addressing these problems. Satellite users would not be adversely affected. Nor would government users sharing these bands.

⁴⁰A 15 MHz maximum bandwidth for the 2.025-2.130 GHz band has been adopted by the Commission. MSS Order, 12 FCC Rcd at 7388. The TIA Fixed Section proposes adding a footnote to the Section 74.637(g) table of maximum authorized bandwidth to reflect this previous change. A similar footnote was added to Section 78.103(e) for the Cable Television Relay Service. Id.

Thus, the public interest compels prompt adoption of this Petition and issuance of a proposed rulemaking.

Improving accessibility of the 23 GHz Band would promote growth of short-haul FS, provide an alternative to the increasingly congested 18 GHz Band, and ease frequency coordination between private sector and Government users. It is essential, however, that the Commission recognize such changes are not a panacea for the alarming decrease in 18 GHz Band availability. The 23 GHz Band propagation characteristics are significantly inferior to 18 GHz Band characteristics. Thus, regardless of what action is taken on this Petition, it is critical that the Commission maintain continued FS user access to the 18 GHz Band.

Respectfully submitted,

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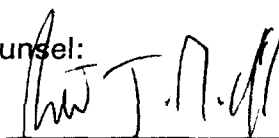
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Appendix A

**Telecommunications Industry Association
Wireless Communications Division
Fixed Point-to-Point Communications Section
FCC Petition for Rule Making**

Analysis of the Proposed FCC Rules

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1. Summary of the Proposed FCC Rule Changes

- Allows conditional licensing in the 23 GHz band if frequencies are prior coordinated with the Federal Government.
- Rechannelizes the 23 GHz band into 50, 40, 30, 20, 10, 5, and 2.5 MHz bandwidth channels to promote more efficient use of the spectrum.
- Allows Common Carriers and Private Operational Fixed users to share the entire 23 GHz band from 21.2 - 23.6 GHz.
- Makes available an additional 200 MHz of spectrum for low power, limited coverage systems in the 23 GHz band, and simplifies the regulations for this service.
- Changes the frequency tolerance for the 23 GHz band to 0.001%.
- Requires spectrum efficiency of 1 bit/second per Hertz for the 23 GHz band.
- Modifies the 10 GHz band antenna standards to allow 2 foot high performance antennas under the Category A standard and 4 foot standard antennas under the Category B standard.
- Modifies the 23 GHz band antenna standards to allow 18 inch high performance antennas under the Category A standard and one foot high performance antennas under the Category B standard.
- Makes minor corrections to the table of maximum authorized bandwidth for Part 101, Subpart C (Technical Standards), and to the frequency assignment tables for Part 101, Subpart J (Local Television Transmission Service).
- Corrects obsolete references to FCC Parts 21 and 94 in Parts 25, 74, 78, and 90.
- Permits digital modulation in all Part 74 Television Broadcast Auxiliary Service bands.
- Extends Part 74 technical standards to the 2110-2130 MHz frequency range for the Television Broadcast Auxiliary Service. Also changes the maximum EIRP limits for short microwave paths and permits automatic transmit power control in this service.

2. Introduction

In this report, the Telecommunications Industry Association, Wireless Communications Division, Fixed Point-to-Point Communications Section ("TIA Fixed Section") discusses recent developments in the fixed point-to-point microwave services since the adoption of Part 101 by the Federal Communication Commission ("FCC" or "Commission") in February 1996. The TIA Fixed Section proposes specific rule changes in Appendix B to address these developments. The proposed changes affect the following four Part 101 frequency bands:

- 10 GHz Band 10.55 - 10.68 GHz
- 18 GHz Band 17.7 - 19.7 GHz
- 23 GHz Band 21.2 - 23.6 GHz
- 38 GHz Band 38.6 - 40.0 GHz

The TIA Fixed Section also proposes rule changes to the Part 74 Television Broadcast Auxiliary Service regulations. This service uses point-to-point microwave links in the 1.990-2.110, 2.450-2.4835, 6.875-7.125 GHz, 12.7-13.25 GHz, and 17.7-19.7 GHz bands to transport video signals from studios to transmitters and to relay Electronic News Gathering ("ENG") broadcast transmissions from remote locations to studios. Rule changes are required to transport digital television over point-to-point microwave in these bands.

2.1 10 GHz Band (10.55 - 10.68 GHz)

In the Second Report and Order for ET Docket 92-9, the FCC designated the 10 GHz band as one of the four primary bands for relocating fixed point-to-point microwave systems from the 1.85 - 1.99 GHz and 2.1 - 2.2 GHz Emerging Technologies bands.¹ Private Operational Fixed operators, including state and local governments, currently are relocating point-to-point systems from the 1.85 - 1.99 GHz band to the 5.925 - 6.425 GHz, 6.525 - 6.875 GHz, 10.55 - 10.68 GHz, and 10.7 - 11.7 GHz bands to provide spectrum for Personal Communications Services ("PCS").

After an initial high level of A- and B-Block relocation activity in 1996, point-to-point relocations stabilized to a steady level in 1997. Through careful frequency planning, PCS operators found ways to avoid many incumbent point-to-point microwave frequencies and to initiate service using only a small amount of their allocated spectrum. However, additional clearing of point-to-point microwave will be required as systems mature and traffic levels increase. The TIA Fixed Section expects a continuing steady level of relocation activity from the 1.85 - 1.99 GHz band to the 10 GHz band over the next 3 to 5 years.

¹ *Redevelopment of Spectrum to Encourage Innovation in the Use of New Telecommunications Technologies (Emerging Technologies)*, Second Report and Order, 8 FCC Rcd 6495, 6509 (1993).

The FCC recently reallocated the 2.110 to 2.130 GHz Common Carrier Point-to-Point Microwave band to the Broadcast Auxiliary Service ("BAS") and to the Cable Television Relay Service ("CARS"). In this proceeding, the FCC also reallocated the 1.990 to 2.025 GHz and 2.165 to 2.200 GHz bands to the Mobile-Satellite Service (see Figure 1). Under these new FCC allocations, the frequency range from 2.025 to 2.130 GHz will be used by BAS and CARS for electronic news gathering services to relay television broadcasts from mobile news vans and helicopters to local television studios. Due to the mobile nature of electronic news gathering and the potential for interference into point-to-point systems, the Commission ruled that point-to-point microwave systems must be cleared from the 2.110 to 2.130 GHz band before BAS and CARS can use the band.²

The TIA Fixed Section expects increasing use of the 10 GHz band by Common Carrier systems relocating from the 2.110 to 2.130 GHz and 2.160 to 2.180 GHz bands, and by Private Operational Fixed systems relocating from the 2.180 to 2.200 GHz band. Since most point-to-point microwave systems are bidirectional, relocation from the 2.180 to 2.200 GHz band also will require relocation from the paired frequencies in the 2.130 to 2.150 GHz Private Operational Fixed band.

Cellular and PCS operators also use the 10 GHz band in their own transmission networks to transport traffic between cell sites and switching centers. Point-to-point microwave is the preferred transmission medium when high reliability is required (e.g., 911 service), when leased lines are unavailable due to geographical constraints (e.g., mountainous terrain), and when leased lines are not cost effective due to poor grade of service or lack of competition with the local exchange carrier. The TIA Fixed Section thus anticipates increasing use of the 10 GHz band by cellular and PCS operators as traffic levels increase and coverage areas expand.

In Section 8., the TIA Fixed Section proposes a change in the 10 GHz antenna standards to permit 2 foot diameter antennas. Currently, the minimum antenna size allowed under Section 101.115(c) is 4 foot.

² *Amendment of Section 2.106 of the Commission's Rules to Allocate Spectrum at 2 GHz for Use by the Mobile-Satellite Service, First Report and Order and Further Notice of Proposed Rule Making*, 12 FCC Rcd 7388 (1997) ("MSS First Report and Order").

2.2 18 GHz Band (17.7 - 19.7 GHz)

The 18 GHz band is normally used in short-haul applications from 3 to 6 miles. Due to the increased effect of rain at higher frequencies, path lengths must be limited to maintain system reliability. Figures 5, 6, 7, and 8 compare the performance of typical digital radios in the 10, 18, 23, and 38 GHz bands for various path lengths and antenna sizes.³ A typical reliability objective is 99.999% (2-way, annual). Assuming 4 foot diameter antennas in Philadelphia, 99.999% reliability can be achieved on a 10, 5.2, and 3 mile path in the 10, 18, and 23 GHz bands, respectively. Path lengths in the 38 GHz band are normally less than 1.5 miles.

Cellular and PCS providers use the 18 GHz band to connect microcells to mobile telephone switching offices and the public telephone network. Universities, corporations, and state and local governments use roof mounted 18 GHz radios to carry local area network traffic between buildings in a campus environment or industrial cluster. Competitive access providers use the 18 GHz band in their local distribution networks to bypass local phone companies. In the future, Local Multipoint Distribution Service ("LMDS") systems in the 28 GHz band will require a transport infrastructure, and may use point-to-point microwave, including the 18 GHz band, in some applications.

Recent interest in the 18 GHz band by satellite interests threatens the continued use of the band for point-to-point systems. Figure 2 shows the Part 101 point-to-point allocations and the Part 25 satellite allocations. Of particular concern is the Teledesic frequency assignment, which covers most of the point-to-point band segments. If millions of earth stations are installed across the U.S., it will become increasingly difficult to coordinate new point-to-point microwave stations in the 18 GHz band. For this reason, the TIA Fixed Section is recommending a number of changes to the Part 101 regulations that would facilitate more intensive use of the 10 GHz and 23 GHz bands as an alternative to the 18 GHz band for medium and short haul applications.

2.3 23 GHz Band (21.2 - 23.6 GHz)

The 23 GHz band is used for the same short haul applications as the 18 GHz band. The band is also used for low power, limited coverage systems described in Section 7. below. However, radio propagation characteristics at 23 GHz are not as favorable as at 18 GHz, and path lengths must be shorter to maintain the same system reliability. One reason for the less favorable propagation characteristics is the increased atmospheric absorption loss at 23 GHz. Figure 4 shows a peak of water vapor absorption in the 23 GHz band, resulting in higher path losses at this frequency.⁴

³ In the 10 GHz band, calculations assume a 128 Quadrature Amplitude Modulation ("QAM") digital radio with Trellis coding, carrying 24.7 Megabits/second (16 DS1) in 5 MHz of bandwidth. In the 18, 23, and 38 GHz bands, calculations assume a 4 QAM digital radio carrying the same 24.7 Megabits/second in 20 MHz of bandwidth.

⁴ *Attenuation by Atmospheric Gases*, ITU-R Recommendation P.676-2 (1995) at pp. 43-46.

The 23 GHz band is shared with the Federal Government.⁵ Consequently, private sector users of the 23 GHz band must be frequency coordinated through the Frequency Assignment Subcommittee ("FAS") of the Interdepartment Radio Advisory Committee ("IRAC").⁶ Due to the many stages of processing within the FCC, NTIA, and FAS, license approvals in the 23 GHz band take anywhere from 2 to 6 months, with an average of 4 months. In the highly competitive cellular and PCS industries, this delay is not acceptable. PCS providers are under intense pressure to put their systems into operation as soon as possible to build market share and to generate the cash flow necessary to pay for infrastructure, operations, and auction costs. Under these circumstances, it is essential that the FCC take action to reduce this processing.

In other bands shared with the Federal Government (e.g., in the 18 GHz band, except in protected areas around Washington D.C. and Denver, Colorado), the Commission will grant a conditional license under Section 101.31(e) if the frequency coordination is completed and certain other conditions are met. Conditional licensing allows an applicant to go into operation immediately after the license application is submitted, at the applicant's own risk. However, conditional licensing is not allowed in the 23 GHz band if the Effective Radiated Power ("E.R.P.") is greater than 55 dBm, and an applicant must wait for NTIA and FCC license approval before going into operation.

To accelerate the frequency coordination process with the Federal Government, the TIA Fixed Section recommends permitting conditional licensing in the 23 GHz band for all systems, including those with E.R.P. greater than 55 dBm (see Section 3.). It also proposes a simple method of frequency coordination with the Federal Government that maintains the established FCC, NTIA, and FAS approval process, reduces the delay time for Part 101 license applicants, and protects all systems against interference.

To support more intensive use of the 23 GHz band, the TIA Fixed Section recommends adoption of a new frequency plan. This frequency plan is described in Section 4. The TIA Fixed Section also recommends the adoption of new frequency tolerance, spectrum efficiency, low power-limited coverage rules and antenna standards (see Sections 5., 6., 7., and 8., respectively).

2.4 38 GHz Band (38.6 - 40.0 GHz)

The 38 GHz has the least favorable radio propagation characteristics of the 4 bands described above. Figure 8 shows that a path with 2 foot antennas in Philadelphia must be shorter than 1.1 miles to achieve a 99.999% reliability.

⁵ 47 C.F.R. §2.106 (1998).

⁶ *Manual of Regulations and Procedures for Federal Radio Frequency Management* (1996) ("NTIA Red Book") at Chapter 4.1. An electronic copy of the *NTIA Red Book* is located on the Internet at:

<http://www.ntia.doc.gov/opadhome/osmhome/redbook/redbook.html>

On October 24, 1997, the FCC adopted the Report and Order and Second Notice of Proposed Rule Making for ET Docket No. 95-183.⁷ In this Report and Order, the FCC decided against imposing a 1 bit/second per Hertz spectrum efficiency requirement for the 38 GHz band. The TIA Fixed Section supports this decision (see Section 6.).

3. Conditional Licensing in the 23 GHz Band

3.1 Need for Conditional Licensing

As discussed in the Introduction, the 23 GHz band is shared with the Federal Government. Private sector users thus must coordinate frequencies through IRAC's FAS. In Section 101.31(e) of its rules, the FCC does not allow conditional licensing in the 23 GHz band for systems with an E.R.P. greater than 55 dBm. Most systems require power levels greater than the 55 dBm limit due to the difficult radio propagation conditions in the band.

Based on recent experience, license applicants in the 23 GHz band must wait 2 to 6 months before the approval process is completed and a license is granted, so that operations can be initiated. The license approval process is described in Figure 11.

The most important action that the Commission can take to encourage the use of the 23 GHz band is to allow conditional licensing for all systems, including those with E.R.P. greater than 55 dBm. The Commission recognized this fact in the Report and Order of WT Docket 94-148, which established FCC Part 101:

Pending an agreement between the Commission and NTIA, we will not allow conditional licensing in the following frequency bands: (1) the 10.6-10.68 GHz band, (2) the 17.7-19.7 GHz band in the states of Colorado, Maryland, and Virginia, and the District of Columbia, and (3) the 21.2-23.6 GHz band for operations with an effective radiated power (E.R.P.) greater than 55 dBm. We hereby delegate authority to the Wireless Telecommunications Bureau and Office of Engineering and Technology to modify the rule regarding conditional licensing, if appropriate, once the Commission and NTIA have reached an agreement regarding coordination of these frequencies.⁸

⁷ *Amendment of the Commission's Rules Regarding the 37.0-38.6 GHz and 38.6-40.0 GHz Bands, Report and Order and Second Notice of Proposed Rule Making*, ET Docket No. 95-183, FCC 97-391 at ¶¶ 58-62 (released Nov. 3, 1997).

⁸ *Reorganization and Revision of Parts 1, 2, 21, and 94 of the Rules to Establish a New Part 101 Governing Terrestrial Microwave Fixed Radio Services, Report and Order*, 11 FCC Rcd 13449, 13462-63 (footnote omitted) (1996) ("Part 101 Report and Order").

The Commission recently reached agreements with the NTIA regarding conditional licensing in the 10 GHz and 18 GHz bands. On October 14, 1997, the Commission released rule changes to Part 101 permitting conditional licensing in the 18 GHz band, except within protected areas near Denver, Colorado and Washington, D.C.⁹ On February 24, 1998, the Commission released additional Part 101 rule changes permitting conditional licensing in the 10 GHz band.¹⁰ The TIA Fixed Section strongly supports these decisions, and encourages the Commission to reach a similar agreement with the NTIA regarding the 23 GHz band.

3.2 Protected Areas Where Conditional Licensing Not Permitted

In Appendix B, Sections 101.31(e)(1) and 101.103(g), the TIA Fixed Section sets forth its proposed conditional authorization rules. To protect critical Government installations in the 23 GHz band, the TIA Fixed Section proposes that the Federal Government designate circular protection areas around sensitive military and agency facilities where conditional licensing would not be allowed. Area boundaries for these protected areas would be defined around a center point of latitude and longitude and listed in Section 101.31(e)(vii). The area boundaries should be large enough to protect against interference and to obscure the exact location of the Government transmitter station(s).

This approach is preferable to designating entire states as protected areas, since a smaller region can be defined using latitudes and longitudes. The Commission recently took this same approach in Section 101.31(e)(1)(vi) when it defined circular protection areas around military bases and radio astronomy observatories in the 10 GHz band. The 10 GHz protected areas are shown on the map of Figure 9.

3.3 Frequency Coordination Procedure for the 23 GHz Band

Outside the protected areas, the TIA Fixed Section's proposed rules for the 23 GHz band require that applicants for FCC licenses prior coordinate frequencies with Federal Government agencies, according to the procedures of Section 101.103(d). When a new frequency is to be coordinated, commercial frequency coordinators, like Comsearch, would send a Prior Coordination Notice ("PCN Notice") to the frequency coordinators representing the affected government agencies. The PCN Notice would include all engineering data necessary to analyze the application. Government agencies would be allowed a 30 day period, as specified in Section 101.103(d), to examine the application and to notify the commercial frequency coordinator of potential interference problems.

⁹ *Amendment of the Commission's Rules to Relocate the Digital Electronic Message Service From the 18 GHz Band to the 24 GHz Band and to Allocate the 24 GHz Band for Fixed Service, Order*, ET Docket No. 97-99, FCC 97-348 at ¶ 3 (released Oct. 14, 1997); 47 C.F.R. §101.123 (1998).

¹⁰ *Reorganization and Revision of Parts 1, 2, 21, and 94 of the Rules to Establish a New Part 101 Governing Terrestrial Microwave Fixed Radio Services, Order*, WT Docket No. 94-148, DA 98-349, App. B at 8 (released February 24, 1998) (to be codified at 47 C.F.R. §101.31(e)(1)).

Under the existing provisions of Section 101.103(d), commercial and government frequency coordinators would be expected to work out potential interference problems, engineer to engineer. This procedure is currently used between point-to-point and satellite coordinators in the shared FCC bands subject to Parts 25, 74, 78, and 101. A similar procedure is used in the Federal Government bands between different agency coordinators prior to submittal of frequencies to NTIA and to IRAC's FAS. The TIA Fixed Section's proposal to impose the 30 day PCN period for completing prior coordination between FCC license applicants and the Federal Government is actually longer than the 15 working days that Federal agencies currently have to examine new applications under NTIA rules.¹¹

Under the TIA Fixed Section's proposal, if all interference problems are resolved between the commercial and government frequency coordinators during the 30 day PCN period, the license applicant could submit an application to the FCC and could begin operation immediately under the conditional licensing provisions in Section 101.31(e). If interference problems are not resolved, conditional licensing would not be permitted and an operator would have to select alternative frequencies or request a resolution of the problems through the formal licensing process.

After the license applicant submits a formal application to the FCC, the application would be processed in the normal manner through the FCC, NTIA, and FAS, and could be rejected at any point in the process. However, since prior coordination would be required, all government agencies would have an opportunity to examine the application and resolve interference problems before the formal FAS license review. As a result, application rejections should be extremely rare. Moreover, conditional authorization permits commencement of operation at the licensee's own risk. If problems arise that cannot be resolved, the non-government licensee would be required to cease transmission.

Frequency coordination procedures are in place to implement the TIA Fixed Section's proposed procedure for commercial-government prior coordination. To perform coordination in the 23 GHz band, the commercial companies in the U.S. that maintain frequency data bases would need engineering data from the Government Master File. These data should be provided in electronic format with periodic updates. The Federal Government currently provides engineering data for the 900 MHz band to commercial frequency coordinators.¹² Furthermore, the release of Government frequency data is authorized under NTIA rules:

In general, nonclassified Federal radio frequency spectrum management information held by NTIA (including access to electronic databases) is available to the public. However, public access to some information is restricted by Federal law. Because of the voluminous nature of some types of information, requesters may be asked to reimburse NTIA for document copying costs.¹³

¹¹ *NTIA Red Book*, Preparation of Applications for Frequency Assignment Action, Chapter 9.16.2 at ¶2.

¹² Frank Wright, FCC Office of Engineering and Technology.

¹³ *NTIA Red Book*, Public Access to the Federal Spectrum Management Process, Requesting Federal Government Spectrum Management Information, Chapter 11.3.

* * * * *

Nothing in this Guide shall preclude any U.S. Government agency from providing its UNCLASSIFIED frequency assignment records to any other entity for coordination of a radio frequency assignment or for the resolution of interference.¹⁴

It is not necessary to provide the name of the specific government agency for each radio transmitter site. However, the responsible frequency coordinator for each transmitter should be identified so that PCN Notices may be distributed and commercial frequency coordinators may consult with government coordinators about potential interference problems.¹⁵ In the FCC frequency bands, commercial frequency coordinators generate PCN Notices automatically by searching for all microwave stations within the coordination area of a proposed microwave site. The coordination area is normally a 125 mile radius around the proposed site, or 250 miles within ± 5 degrees of the main beam of the antenna. PCN Notices are generated by computer and sent by mail.

The automated production of PCN Notices greatly reduces the number of applications that responding frequency coordinators must analyze. Without this system, a coordinator would have to analyze hundreds of applications each year to find the few applications that may affect a particular microwave station. Recently, the National Spectrum Managers Association developed a computerized format for electronic transfer of PCN Notices. Commercial coordination companies plan to use this format to distribute PCN Notices over the Internet in the future. Using a similar method, coordination companies could send electronic PCN data directly to the NTIA in a format compatible with the Government Master File.¹⁶ These data could be posted on the NTIA web site or computer bulletin board for the convenience of agency frequency coordinators.

Commercial coordination companies also provide protection service for their clients. For each protected station, coordination companies review PCN Notices, analyze potential interference cases, and consult with other frequency coordinators if predicted interference levels are unacceptable. Under the TIA Fixed Section's proposal, Federal agencies may contract with commercial coordination companies for protection services in the shared 23 GHz band. Federal agencies also may contract with commercial companies to coordinate new point-to-point microwave frequencies in shared bands.

¹⁴ *NTIA Red Book*, NTIA Security Classification Guide for Frequency Assignment Records, Annex C, ¶ 2.1.

¹⁵ A list of Federal Government frequency coordinators, including agency, geographical responsibility, and telephone number, is located on the Internet at: <http://www.ntia.doc.gov/opadhome/osmhome/contacts.html>.

¹⁶ *NTIA Red Book*, Preparation of Applications for Frequency Assignment, Chapter 9. The electronic data format is described in this chapter.

In Part 2, Subpart B, the FCC defines generic rules for Government and non-Government use of frequencies, applicable to all bands in the Table of Frequency Allocations. Specifically, Section 2.103 defines the special rules for Government use of non-Government frequencies:

Such operation shall be in accordance with Commission rules governing the service to which the frequencies involved are allocated.¹⁷

Although Section 2.103(b) is not directly applicable to shared Government and non-Government frequency bands, it establishes a precedent for having Government agencies follow FCC - prescribed coordination procedures. Consistent with this policy, the TIA Fixed Section proposes that Government agencies follow the prior coordination procedure prescribed in Section 101.103(d) for the shared 23 GHz band, as described above. Under this procedure, Government agencies would not be required to distribute PCN Notices, but would be required to review PCN Notices from non-Government license applicants within the specified 30 day period and to participate in the frequency coordination process in a manner consistent with national security directives. Implementation of this proposal would require a change to the NTIA Red Book.

It is absolutely critical that the current system of frequency coordination be changed in the shared 23 GHz band. Under the current system, Federal agencies coordinate frequencies without having any information about non-Government frequencies prior coordinated in the area. The FCC does not perform frequency coordination, and cannot identify if a proposed Government system will cause harmful interference to a non-Government system. Commercial coordination companies have a data base of FCC licensed frequencies, but no information about Government frequencies. As a result, commercial coordinators have no way of knowing if a particular frequency will be accepted or rejected by the Federal Government. If the frequency is rejected, they must restart the entire licensing process.

Interference problems were infrequent in the past because most Government microwave paths in the 23 GHz band are low power, limited coverage systems with a limited range of interference and because the 23 GHz band is relatively uncongested compared to lower frequency bands. However, the TIA Fixed Section expects a large increase in non-Government use of the 23 GHz band in the near future. The current system must be changed to accommodate this anticipated future growth.

The TIA Fixed Section's proposed prior coordination and conditional licensing procedures, described above, will ensure that Government and non-Government systems are protected from interference. These procedures also will allow Common Carrier and Private operators to avoid the long delay times associated with the current system.

¹⁷ 47 C.F.R. §2.103(b) (1998).

4. Proposed Frequency Plan for the 23 GHz Band

Figure 3.1 shows the TIA Fixed Section's proposed 23 GHz frequency plan. This plan is based on the current industry standard plan, which consists of 24 pairs of 50 MHz channels. Each 50 MHz channel would be subdivided into one 40 MHz channel, one 30 MHz channel, two 20 MHz channels and five 10 MHz channels (see Figure 3.2). The center 10 MHz channel in each 50 MHz block has the same frequency as the associated 50 MHz channel, permitting upgrades in traffic capacity without a frequency change. Traffic upgrades also may be performed from a 10 MHz channel to a 30 MHz channel without a frequency change.

The TIA Fixed Section's plan reserves several portions of the band for narrow band 2.5 and 5 MHz bandwidth channels. These portions of the band may be used for wide band traffic (10 to 50 MHz bandwidth), but only if all other wide band channels are blocked. The frequencies proposed for narrow band channels are the highest numbered channels in the Common Carrier and Private Operational Fixed segments of the 23 GHz band. Since frequency planners tend to select the lowest numbered frequencies first, these channels should be the least congested frequencies in the band.

None of the new channels overlap between two 50 MHz blocks. This lack of overlap will allow an orderly transition to the new frequency plan without causing interference to existing systems.

Under Section 101.147(s), the segments of the band from 21.8 - 22.0 GHz and 23.0 - 23.2 GHz are available for low power, limited coverage systems. These systems are used for perimeter surveillance applications at military bases or correctional facilities, and for remote video monitoring of highway traffic conditions.

Most low power, limited coverage systems have used analog modulation in the past. However, current generation radios use digital techniques. Using currently available video compression technology, remote video monitoring may be performed at lower cost, using lower data rates and operating in less bandwidth than the older generation analog systems.

Frequency planners report severe congestion in the low power, limited coverage frequency band. For this reason, the TIA Fixed Section recommends that an additional 200 MHz must be made available to this service. The new frequencies would be adjacent to the current low power band in the 21.8 - 22.0 GHz and 23.0 - 23.2 GHz segments of the band and would be reserved primarily for narrow band systems. However, wide band systems might use the frequencies if all other wide band frequencies are blocked. The regulations for low power, limited coverage system are discussed in Section 7. below.

Footnote /12/ of the table of frequency assignments, listed in Section 101.147(a), states that half the 23 GHz band is reserved for Common Carriers and half is reserved for Private Operational Fixed users. This band partition between Common Carrier and Private users must be removed, so that, consistent with the underlying goals of Part 101, all users share the entire band equally. This change will prevent excessive congestion in a part of the band and thus will promote more efficient use of the spectrum.

The TIA Fixed Section recommends applying a spectrum efficiency requirement of 1 bit/second per Hertz to the 23 GHz band. This requirement is discussed in more detail in Section 6. below.

Center frequencies for the TIA Fixed Section's frequency plan are listed in Appendix B, Section 101.147(s).

5. Frequency Tolerance Specifications for the 23 GHz Band

In Section 101.107(a), the frequency tolerance for the 23 GHz band is specified as 0.03%. This tolerance is equivalent to a frequency drift of 7 MHz at 23.6 GHz. When the frequency tolerance requirements originally were defined for the 23 GHz band, most radios used analog modulation techniques (e.g., frequency modulation) and were coordinated for the full 50 MHz channel bandwidth. This amount of frequency drift was acceptable since most of the power in frequency-modulated analog radios is concentrated at the carrier frequency.

However, most of the radios licensed today are digital and occupy 75% or more of the channel bandwidth. The frequency tolerance specification of 0.03% will result in excessive frequency drift into adjacent channels when the band is rechannelized into narrow band channels of 20, 10, 5, and 2.5 MHz. To successfully rechannelize the 23 GHz band into narrow band channels, the TIA Fixed Section recommends that the FCC tighten the frequency tolerance specification to 0.001%. This frequency tolerance would be phased in after a Transition Period (18 months for manufacturers and 24 months for licensees, from the date these new rules become effective). Under TIA Fixed Section's proposed rules, radio manufacturers may deliver radios using the 0.03% specification until the end of the 18 month Transition Period. License applicants may apply for new stations using the 0.03% specification until the end of the 24 month Transition Period. Existing stations and pending licenses would be grandfathered after the 24 month Transition Period, provided that the stations do not cause harmful interference to other licensees.

In the 1980's, the FCC rechannelized the 18 GHz band into narrow band channels. The frequency tolerance was tightened as part of the rechannelization process from 0.03% to 0.003% in two segments of the band, and from 0.03% to 0.001% in the remainder of the band. According to footnote /4/ of Section 101.107(a), radio manufacturers were given until December 1, 1988, to modify their 18 GHz point-to-point microwave products to meet the new standard for frequency tolerance. The TIA Fixed Section proposes a similar tightening of the specifications for the 23 GHz band.

Most point-to-point microwave manufacturers design a family of radios for various frequency bands using common modulators, demodulators, IF components, and mechanical parts. One family of radios may cover the lower frequency bands from 2 to 11 GHz, using complex modulation techniques to meet the higher spectrum efficiency requirements and employing the advanced propagation countermeasures needed for long distance microwave paths. Another family may cover the higher microwave and millimeter wave bands used for short distance paths (e.g., 15, 18, 23, and 38 GHz). Typically, the only difference between products within a family is the RF components.